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**SCHWEIZERISCHE EIDGENOSSENSCHAFT
CONFÉDÉRATION SUISSE
SWISS CONFEDERATION**

Bescheinigung

Die beiliegenden Akten stimmen überein mit den ursprünglichen Unterlagen der auf den nächsten Seiten bezeichneten, beim unterzeichneten Amt als Anmeldeamt im Sinne von Art. 10 des Vertrages über die internationale Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) eingegangenen Patentanmeldung.

Attestation

Les documents ci-joints sont conformes aux pièces originales relative à la demande de brevet spécifiée aux pages suivantes, déposées auprès de l'Office soussigné, en tant qu'Office récepteur au sens de l'article 10 du Traité de coopération en matière de brevets (PCT).

Confirmation

It is hereby confirmed that the attached documents are corresponding with the original pages of the international application, as identified on the following pages, filed under Article 10 of the Patent Cooperation Treaty (PCT) at the receiving office named below.

DOCUMENT DE PRIORITÉ

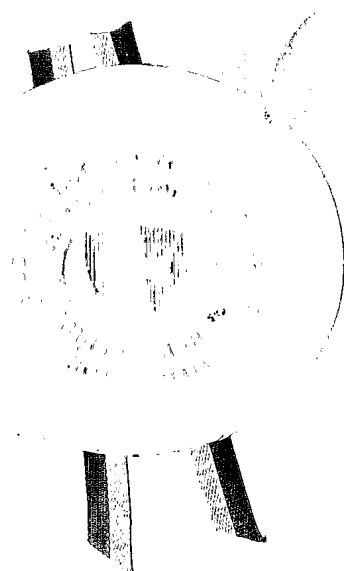
PRÉSENTÉ OU TRANSMIS
CONFORMÉMENT À LA
RÈGLE 17.1.a) OU b)

Bern, 24. März 2005

Eidgenössisches Institut für Geistiges Eigentum
Institut Fédéral de la Propriété Intellectuelle
Swiss Federal Intellectual Property Institute

Administration Patente
Administration des brevets
Patent Administration

Rolf Hofstetter



Anmeldeamtsexemplar

222-5.B.WO-P

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PCT REQUEST

Original (for SUBMISSION)

0	For receiving Office use only	
0-1	International Application No.	PCT/CH 2004 / 00164 ✓
0-2	International Filing Date	19 MARS 2004 (19. 03. 2004) ✓
0-3	Name of receiving Office and "PCT International Application"	RO/CH-Demande international PCT

0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared Using	PCT-SAFE [EASY mode] Version 3.50 (Build 0002.150)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Swiss Federal Intellectual Property Institute (RO/CH)
0-7	Applicant's or agent's file reference	222-5.B.WO-P
I	Title of Invention	METHOD AND SYSTEM FOR DETECTING A LEAKAGE IN A PIPELINE OR SIMILAR CONDUIT
II	Applicant	
II-1	This person is:	applicant only
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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
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V	DESIGNATIONS	
V-1	The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.	
VI-1	Priority Claim	NONE
VII-1	International Searching Authority Chosen	European Patent Office (EPO) (ISA/EP)

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VIII	Declarations	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	Check list	number of sheets	electronic file(s) attached
IX-1	Request (including declaration sheets)	3 4*	-
IX-2	Description	2	-
IX-3	Claims	1	-
IX-4	Abstract	1	✓
IX-5	Drawings	3	-
IX-7	TOTAL	10 11*	
	Accompanying Items	paper document(s) attached	electronic file(s) attached
IX-8	Fee calculation sheet	✓	-
IX-17	PCT-SAFE physical media	-	✓
IX-19	Figure of the drawings which should accompany the abstract	3	
IX-20	Language of filing of the international application	English	
X-1	Signature of applicant, agent or common representative		
X-1-1	Name:	ROLAND, André	
X-1-2	Name of signatory		
X-1-3	Capacity		

*
Ro

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Original (for SUBMISSION)

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	19 MARS 2004 (19.03.2004)
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/EP
10-6	Transmittal of search copy delayed until search fee is paid	X

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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5 **Method and system for detecting a leakage in a pipeline or similar
conduit**

Field of the invention

10 The present invention relates to pipelines or similar conduits which are used for the transfer of fluids such as gas, water or oil.

More precisely the invention relates to methods and systems for detecting leakages in such conduits.

15 Detailed description of the invention

The principle underlying the invention consists in measuring the pressure profile and, optionally, the temperature profile of a solution front, e.g. a saline solution, traveling through an umbilical tube laid within and along the pipe (see Figures 1 and 2).

20 The pressure profile measurement can be similar to the pressure profile measurement used in the medical field as disclosed in US patent 6 450 972 , International patent application PCT/03/00227 or in European patent application EP 1 371 325 A1.

25 The solution travels through the pipe and its front pressure is frequently measured creating thereby a discrete pressure and, optionally, temperature profile.
Whenever a pressure drop/increase is encountered the solution front will be deformed and its measured pressure will drastically change. Since the position of the solution front along the umbilical tube can be determined (e.g. according to
30 the methods disclosed in the previous cited patent documents), the leakage point can be localized.

In a preferred embodiment of the invention (see Figure 3) a saline solution is used. The position of its front along the umbilical tube can be determined in
35 measuring the electrical resistance or capacity of the saline solution.

A deformation of the saline solution front caused by the pressure outside the umbilical tube will lead to a geometry change and thereby a change in the

5 electrical resistance or capacitance which, for instance, can be measured by a leakage current and a current to voltage converter as disclosed in PCT/CH03/00227.

The following system may be used with the previous cited embodiment. It
10 includes :

- A PPT umbilical tube laid within and along the main pipe which comprises a magnetic flat top in order to fix it to the main pipe, a flexible U-shape bottom capable of being deformed by pressure variation, an external coating with an electrical conducting paint in order to transmit signals;
- 15 - A saline solution to be pumped through the pipe from one end to the other ;
- Pressure and optionally temperature sensors and, when a current to voltage converter is used, two capacitive sensors. The sensors preferably have a thick membrane in order to avoid parasitic effects and are placed at the beginning and at the end of the umbilical tube;
- 20 - A pump adapted for moving the saline solution all the umbilical tube.

When used with oil pipelines, to have a rough screening, in order to localize a leakage or an important drop in the pressure, a measuring point every 200 meters is sufficient. In such a case, a software makes the extrapolation between these
25 points.

The invention is of course not limited to the above cited examples. It includes any pipe leakage detecting method which can dynamically measure the pressure and the position of a solution front traveling in a flexible tube laid within and along a
30 pipe.

5

Claims

1. Method for detecting a leakage in a pipeline or similar conduit characterized by the use of an umbilical flexible tube laid within said pipeline, the displacement of a solution column within said umbilical flexible tube, the measurement of the pressure at the front of said solution column and the localization of said front from the said measured pressure.
2. Method according to claim 1 furthermore comprising the measurement of the temperature at the front of said solution column.
3. Method according to claim 1 or 2 wherein the solution is a saline solution and wherein the measurement of the pressure is obtained via the measurement of the electrical resistance or capacity.
4. System for detecting and localizing a leakage in a pipeline or similar conduit using the method of claim 1,2 or 3 characterized by the fact that it comprises :
- An umbilical flexible tube adapted to be laid within a pipe;
 - Pumping means adapted for moving a solution within said umbilical flexible tube;
 - Pressure measuring means adapted for determining the pressure at the front of a solution moving within said flexible tube;
 - Localization means adapted for determining the position of a solution front from the measured pressure of said front.
5. System according to claim 4 furthermore comprising temperature measuring means adapted for determining the temperature at the front of a solution moving within said flexible tube.
6. System according to claim 4 or 5 furthermore comprising capacitive sensors adapted for measuring the electrical capacity of a solution moving within said flexible tube.

5

Abstract.

- 10 The invention concerns a method and a system for detecting a leakage in a pipeline or similar conduit characterized by the use of an umbilical flexible tube laid within said pipeline, the displacement of a solution column within said umbilical flexible tube, the measurement of the pressure at the front of said solution column and the localization of said front from the said measured
- 15 pressure.

(Fig. No. 3)

Fig. 1

